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Reclamation of
Agricultural Land by Diking

Civil Engineering

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RECLAMATION
OF
AGRICULTURAL LAND
BY
DIKING

BY
CLEVES HARRISON HOWELL

THESIS
FOR
DEGREE OF BACHELOR OF SCIENCE
IN
CIVIL ENGINEERING

COLLEGE OF ENGINEERING
UNIVERSITY OF ILLINOIS

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May 24, 1905

THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

CLEVES HARRISON HOWELL

ENTITLED RECLAMATION OF AGRICULTURAL LAND BY DIKING

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE

OF Bachelor of Science in Civil Engineering

Ira O. Baker.

HEAD OF DEPARTMENT OF Civil Engineering



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Statement of the Problem.

The tract of land under consideration lies on the south bank of the Illinois river adjoining Beardstown on the south-west. It comprises nine thousand acres which are subject to the normal outflow of the river. The soil is about 4 feet of river silt upon a deep stratum of sand.

This tract is cut up by three narrow and deep "lakes" or bays running north and south, and having an outlet near the south end of the land. About one mile south of this outlet a stream called Indian Creek runs into the river. A highway runs from Beardstown southward about three miles south-east of the river. The land to the south of this highway is sandy in character and drains away from the loamy land on the north. The road runs

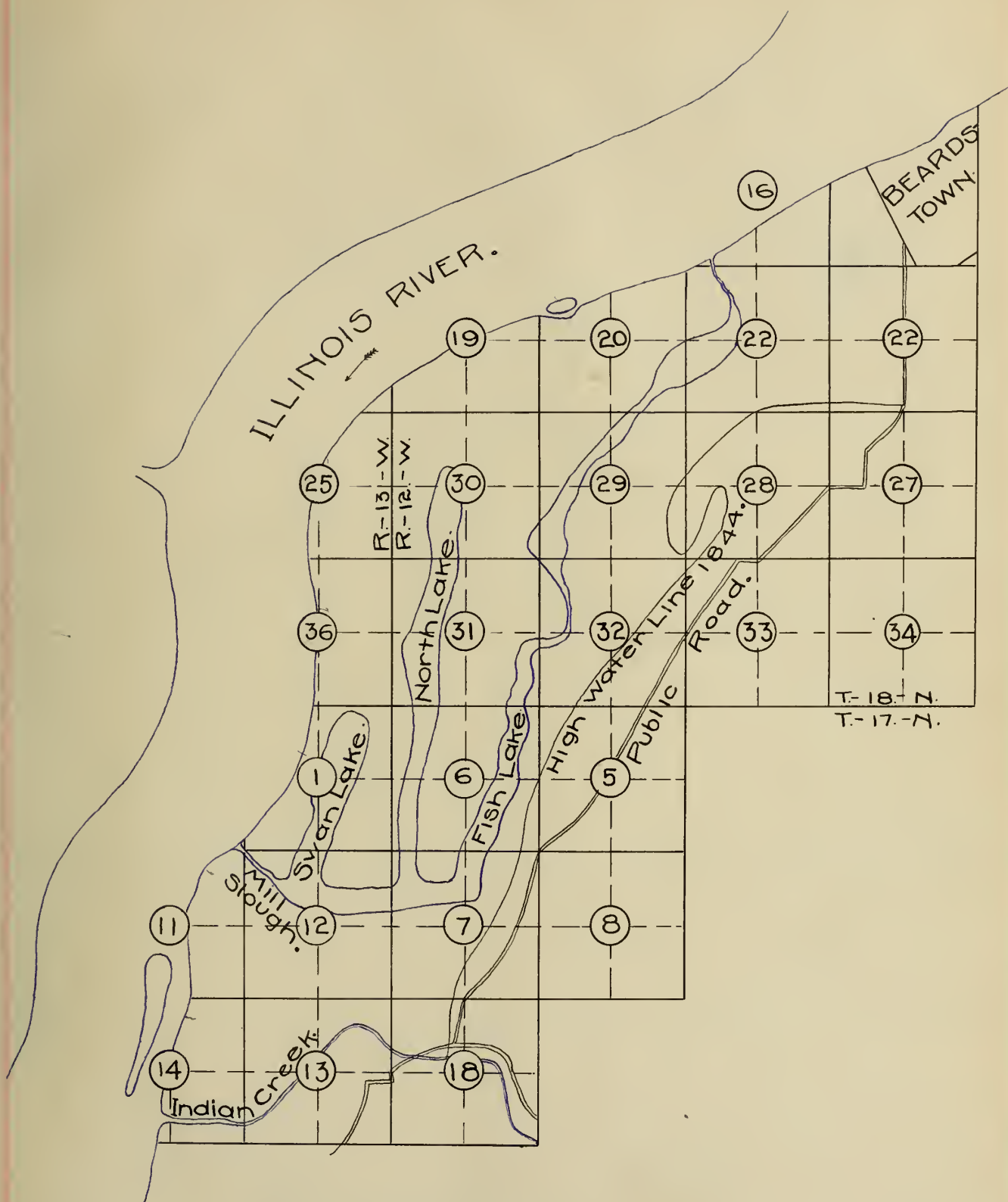


on the edge of the silt deposit.
difference between the two soils
is very noticeable along this
highway. On the right as one
approaches Beersheva the soil
is very sandy, on the left it is
entirely free from sand. So marked
is this characteristic that if a hand-
ful of the latter soil is rubbed
between the hands not the least
trace of sand is noticed.

The proposition is to reclaim
this land for agriculture by building
a levee to prevent the water from
overflowing it and to drain it by
means of pumps and ditches.

Discussion of Engineering Problem

Geological Factors. This individual
tract of land owes its existence in
its present form to the tendency of
silt-bearing streams to fill up their
beds by the sediment they carry.



Scale 1 inch = 1 mile.

and as a result new channels are constantly forming offering easier access to the mouth than the previous ones which are choked with silt; these in time some become covered with deposit, and left by the waters of the river the leveling action of rain and wind tend to fill up still more completely what once were the channels until we have an area of comparatively level land cut up sometimes, as in this case, by the dwindling remains of the former channels. On this tract the deposit is from three to four feet thick of the blocked silt.

Topographic and Hydrographic Conditions

These can best be understood by a reference to the map on page 3. The three "lobes" or bayous of themselves furnish natural drainage outlets.

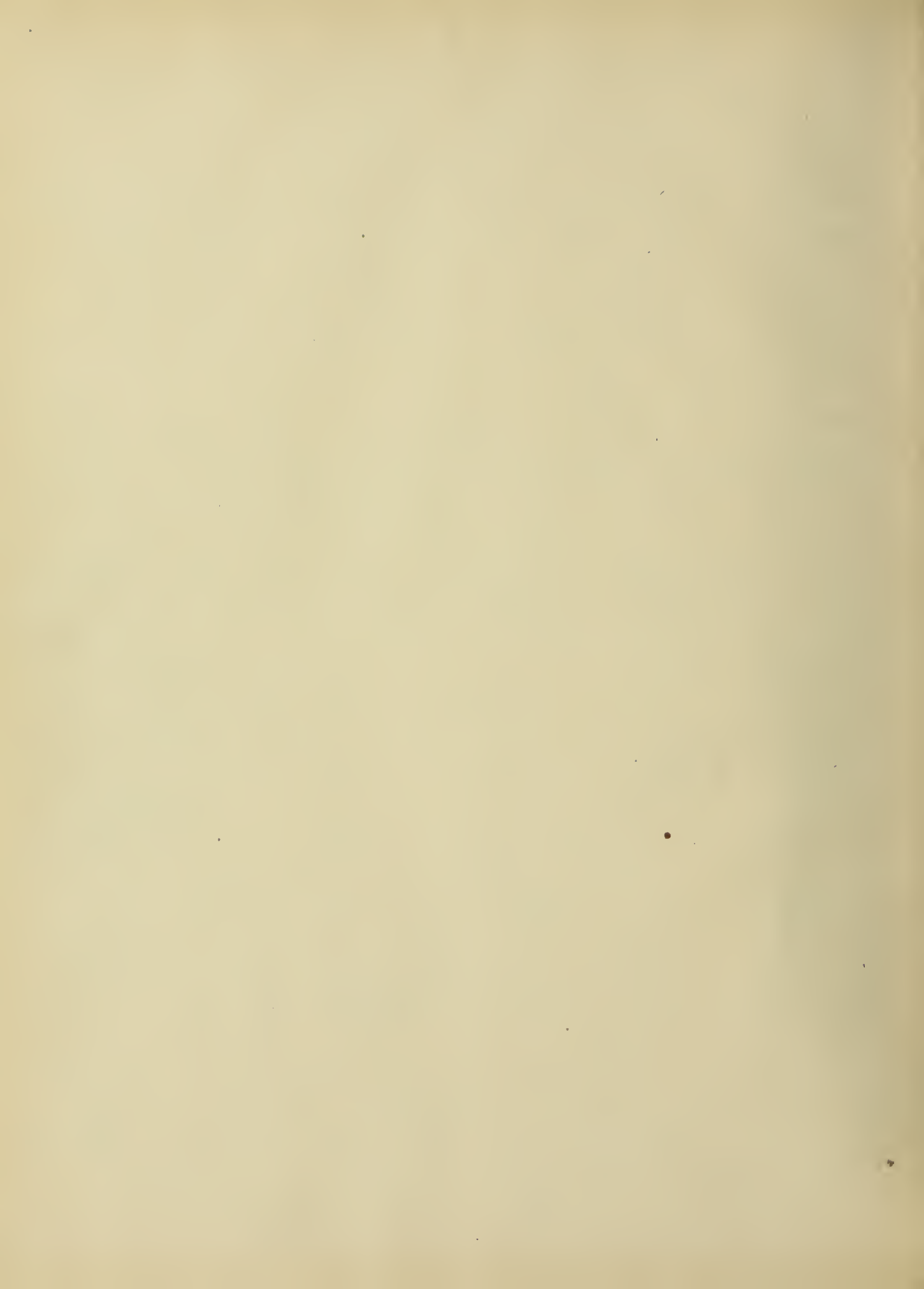
Sevan Lake is about fifteen feet deep through out. North Lake is about the same depth to the middle of Section 31, and Irish Lake has also considerable depth up to the narrow portion in Section 32.

The average level of the bank is about 10 feet above the normal stage of the river or stream plain. From the top of this bank the ground slopes slightly toward the highway, so that the drainage of the adjoining lands need not enter into consideration.

The Sevan River at low water runs slowly by this tract of land and what current there is is diminished by "backwater" when the river is high, this being the only time when the levee on under pressure the consideration of the "sewer" can therefore be neglected.

Plan for Reclamation.

It is proposed to construct a levee along the river bank and along the south side of Indian Creek to the highway. The three lakes, Swan, North and Fish will not be drained but will be left to serve as drainage ditches. A system of lateral ditches will be dug leading into the several lakes. A pumping station will be established to remove the rainfall and seepage. Ten miles of levees will be required, judged by experience on similar work the cross section should be about 4 feet wide on top with slope of 3 to 1 on the river side and 2 to 1 on the land. To safely clear the crest of the highest water known, that of 1844, the levees should be 12 feet high above the banks. This height will give a levee 14 feet thick at the high water mark.



much longer as long as
 these it would be economical
 to construct them by a floating
 bridge. However while the
 bridge is being built or transported,
 if it be not built on the right,
 time could be gained by con-
 structing the lower levee of
 four feet perhaps by slip-scraps
 and starting to cap the land
 at once, &c. The extreme high-
 water above mentioned does
 not occur every year. Afterwards
 when the bridge was com-
 pleted the remainder of the
 levee could be consolidated by
 building over the old scummy built
 center the desired height was
 reached, this method would
 give a better levee than by
 constructing it all at once as
 the lower portion would have
 time to consolidate and form
 a sort of a gudder wall in
 the bottom of the levee.

By this means it would

be possible to make on
 the movement somewhat sooner
 than if no cuttivation was
 done until the extreme levee
 was completed. The method
 of construction with the dredge
 would be to fast it in a
 horse pit. on the inner side
 of the levee and work for
 the required height allowing the
 levee to assume its natural
 cross section. Because in work
 of this kind it has been found
 much cheaper to do this than
 to work for the theoretical
 cross section. This makes
 a rough looking job but
 the levee is a good deal stronger.
 This method of course requires
 more material than would be
 called for in the theoretical
 cross section but it is really
 cheaper for the contractor to
 handle the increased amount
 of earth than it is for him to
 obtain the theoretical cross section

and therefore the work should be paid for according to the amount in the specifications.

The dredge should have a boom long enough to reach from the bottom of the borrow pit to the center line of the levee, this requires a boom much longer than those ordinarily on dredges, the one used on the levee built by Cheney and Sauer across the river from this land had a boom 85 feet long and one of about the same length would be required here.

This dredge had a dipper capacity of $2\frac{1}{2}$ cubic yards and with an efficient crew handled on an average 50000 cubic yards a month.

The theoretical quantity of earth in the levee of above length and cross section is 800 000 cubic yards although as it would be constructed

it would probably have in excess of a million on account of the method of construction before referred to. At present prices and conditions, the levee could be constructed under contract for 12 cents a cubic yard, the contractor furnishing the dredge.

For the greater part of the distance the borrow pit would be separated from the river proper by a tongue of land, this of course diminishes the damage sustained, but when overgrown with trees and brush it would afford a very good protection to the levee which would compensate for the loss in land.

Methods of Drainage

The most feasible method which suggests itself is to utilize the three large lakes (as shown on map page) as drainage ditches.

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and from them run small
open ditches or laterals. A
pump station will be necessary
to remove the water collected
by the main and laterals.
Several short mains should be
engaged to shorten the length
of these laterals and facilitate
the drainage.

The mains should be
about 16 feet deep and 25 feet
wide on the bottom, expiring
with the ditches in the land
reclaimed by Christy and some
shows that this soil will stand
with quite steep slopes, in the
land they have no trouble with
ditches having slopes of 2 to 1, and
the same slope could be safely
used here. The smaller lateral
ditches will be about 4 feet
wide on bottom with slopes
the same as in the large
ones.

At present places the main
ditches could be excavated

at 8 cents per cubic yard and the laterals at 11 cents, it is estimated that there will be 150000 cubic yards in the main and 100000 in the laterals.

A certain amount of tilling will be necessary to properly bring the land to its highest efficiency.

The natural right for the pumping station is on the north side of Mill Street, the outlet of the lake system.

Experience on the Chusey and Souer's land before referred to, shows that not over 100 days pumping are necessary during the year, with pumps having a capacity of 30000 gallons a minute, and on this land the number of days pumping can be reduced probably 10 percent or more on account of the water on the land back of it draining away from it as it is not the case across the main when it was necessary to construct an intercepting ditch.

to handle the water from the highland behind.

For many obvious reasons centrifugal pumps will be selected, two 15 inch and one 24 inch Morris centrifugal pumps have a capacity of 30000 gallons a minute and will require about a 150 horse power engine to operate them.

A fleet of this capacity will be plenty large enough to handle all the rainfall and seepage.

- Estimate of Cost.

A set of four 15 inch boilers set up and ready to run cost about \$1000 a horse power. Good stationary engines can be bought at about \$1200 a horse power and the cost of installation is between \$100 and \$200 a horse power so that the cost of the engine might be figured about \$2000. The three pumps would cost about \$1300. A four pump house

could be built and pump con-
nections made for 50000⁰⁰.

A statement of cost therefor
would be as follows.

800000 cu. yds. levee	@ 12¢	\$ 96000.00
150000 " " main ditch	@ 8¢	12000.00
100000 " " lateral "	@ 11¢	11000.00
Pump plant		9800.00
Total cost		128800.00

The yearly expense on the levee
and ditches will be practically
nothing. About 1.0 cents per
horse power per hour is the cost
under these conditions for operating
an engine of this type, or say
for a period of 30 days \$1500⁰⁰ for
pumping.

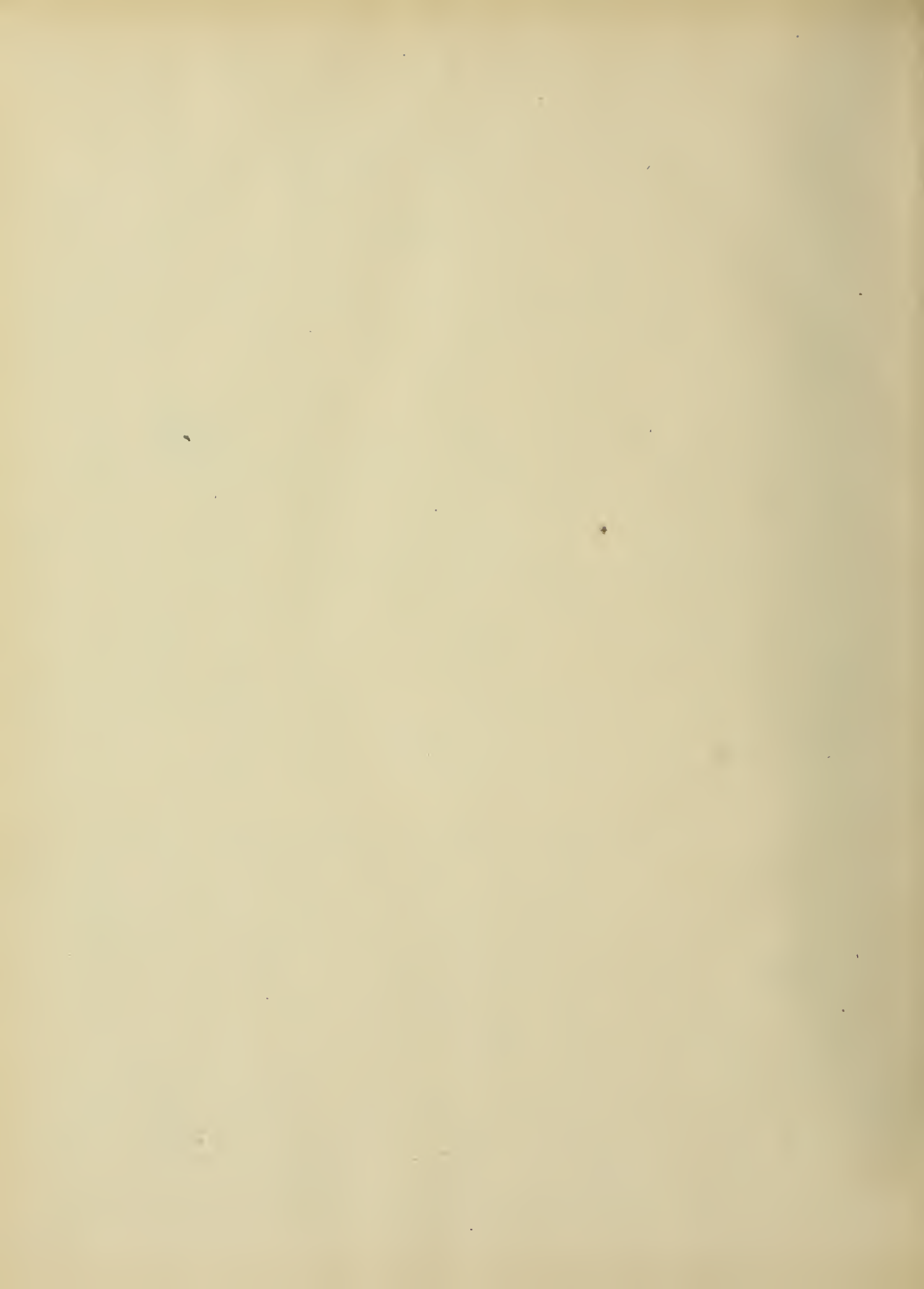
Discussion of Economic Factors.

Present value of Land. The present
sale price of the land is between
\$5⁰⁰ and \$20⁰⁰ an acre, the average
being about \$15⁰⁰. The land is
practically worthless for agriculture.

now its only value being the fish which can be taken from the lakes. The fishing is carried on during the months of January and February, about 7 or 8 carloads a week are shipped out of Beardstown for the rest of these months, the lakes on this tract of land furnishing a large proportion of this amount. One lake of 200 acres in the Chazy and Lacey land yields on an average of \$5000.00 worth of fish per annum. Reclaiming will tend to increase rather than diminish the income from the fishing.

Cost for Area of Improvements

The initial cost per acre for the levees, ditches and pumping outfit will be \$14.31. Cost of clearing land of trees brush and stumps will be \$6.00 an acre and about 2500 acres will require clearing which makes the actual cost per acre for clearing \$1.66 The filling



in Chusey and Soer's land amounted to \$5.00 an acre, and this will be taken as the cost in this case, about 4000 acres will require tiling which makes the actual cost for acre \$2.22. The total cost for acre will then be as follows:-

Sewers, Streets, Pump stations	\$14.31
Clearing land	1.66
Tiling	2.22
Total cost for acre.	\$18.19

The value of the land after reclamation can be approximated by the value set on the land already reclaimed across the river, this land runs from \$75.00 to \$100.00 an acre at the present time.

The productiveness of the reclaimed land will equal any farming lands in the country as it is always insured against drought and if tiled and drained properly no trouble will be experienced from water. The fishing in the lakes will not be injured by reclaiming but

improved

Legal Considerations

The method to be followed by the owners of the land which it is proposed to reclaim is to become incorporated in a Drainage District under the statute provided for that purpose, see the Illinois Revised Statutes 1891 page 578.

This statute provides that when a majority of land owners who represent one third of the area of the land petition the court for the formation of a drainage district the court shall appoint three commissioners to investigate the proposition and report upon it to the court.

If the court approves the plan and reports of the commissioners a jury of twelve men is appointed who personally inspect the land and ascertain the benefits or damages sustained by the different parts and make out an assessment accordingly.

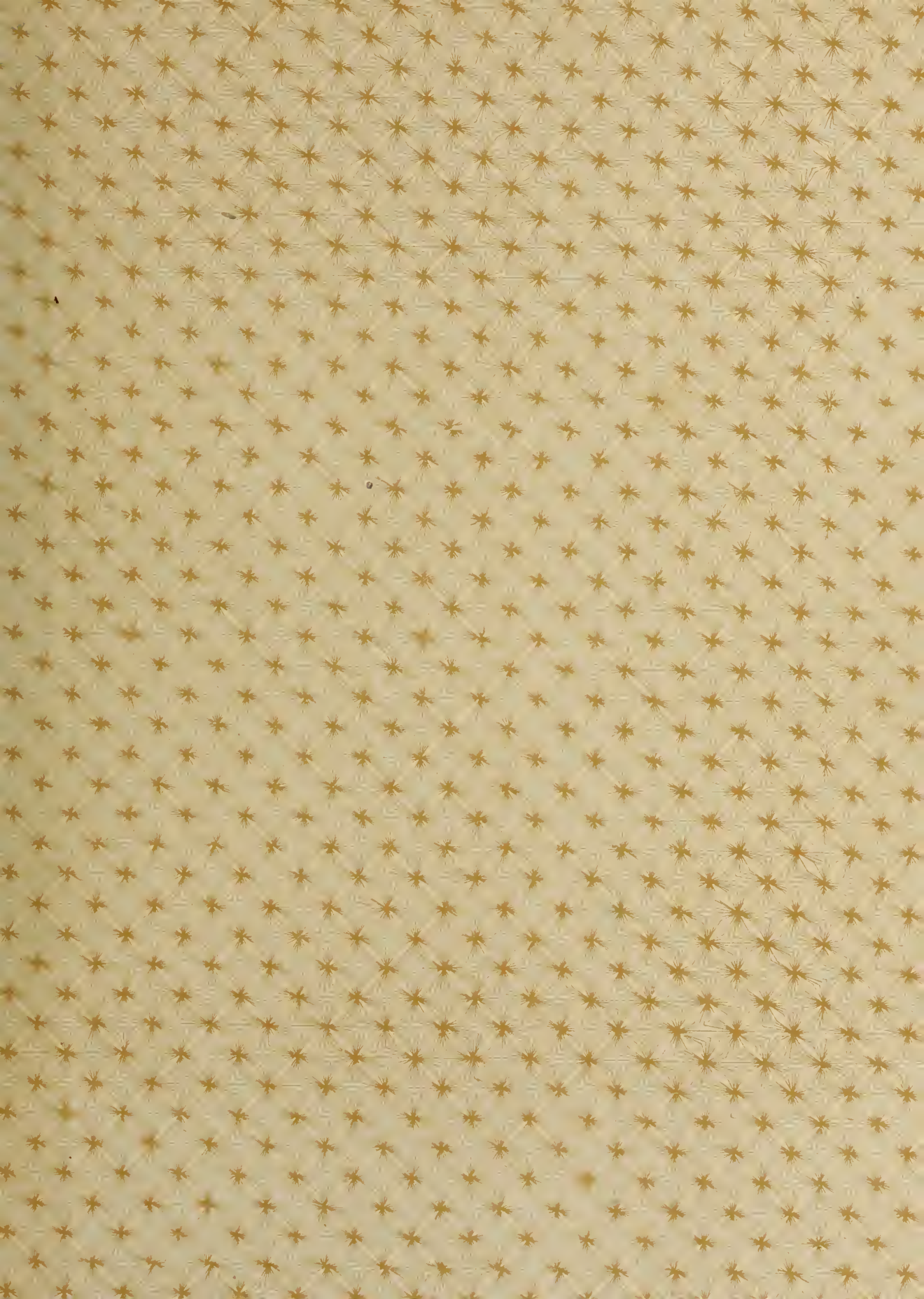
Conclusion.

From a consideration of the foregoing discussion and plan it is to be taken that this individual tract of land is exceptionally well located for reclaiming. The soil is good, the engineering ~~simple~~ and the yearly expense from pumping but about 25 cents an acre. The productiveness of the investment as a whole is established by the success attained under exactly similar conditions across the river and the proposition may be considered as a safe investment which will pay large dividends.

Notwithstanding the above facts however, the difficulty in carrying out the idea is that the present owners of the land have not sufficient money to reclaim the land themselves; and capitalists are unwilling as yet to advance money for much more than one half the present sale value of the land, and as

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and so this land will probably
be in stores for some time until it be
bought by persons who believe
in its possibilities and have
money enough to develop them.





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